S/TSIU Doc. 60

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January 28, 2008

Mr. Timothy E. Eastep, Manager
Environment, Land & Water Department
Chino Mines Company
P.O. Box 7
Hurley, New Mexico 88043

RE: Response to informal Chino comment letter on the Human Health Risk Assessment
Smelter and Tailing Soils Investigation Unit (S/TSIU)
Chino Administrative Order on Consent (AOC)

Dear Mr. Eastep:

The Ground Water Quality Bureau of the New Mexico Environment Department (NMED) received the informal Chino Mines Company comment letter on November 16, 2007. NMED and Gradient Corporation reviewed the comment letter and provides the following responses to the Chino comments.

General Comments

1. Executive Summary and Risk Communication

Chino shares NMED's concerns about the difficulty in communicating complex risk assessment information to the public in a meaningful and accessible manner. Simple editorial changes can often help put potential risks in context. The Executive Summary and other areas of the report combine firm findings of risk with confusing statements like "considerable uncertainties" (paragraphs 6 and 7 in the Executive Summary) that are potentially misleading. For example, the sentence in paragraph 6 of the Executive Summary stating, "however, these cancer risks are largely driven by the consumption of locally grown foods, exposure pathways that include considerable uncertainties" should be edited to be consistent with the last sentence of the second paragraph, "however, these cancer risks are driven largely by the consumption of locally grown foods, exposure pathways that were evaluated conservatively and tend to overestimate risk." Similarly, in paragraph 7 regarding non-

cancer risks, the sentence could read, "however, these non-cancer risks are largely driven by the consumption of locally grown foods, exposure pathways that were evaluated conservatively and tend to overestimate risk."

Response: The text will be revised.

2. Smelter Exposure Area

Chino previously discussed with NMED the fact that the Smelter operational area was not to be included in the HHRA because there are other regulatory vehicles and permits which govern cleanup in this area. The smelter was in operation when the AOC was executed and thus the New Mexico Occupational Safety and Health Administration/Mine Safety and Health Administration (OSHA/MSHA) covered human exposure at the time and DP 1340 governed the stack demolition and closure of this industrial area. Gradient refers to the smelter in the present tense and it is not clear that the smelter area has undergone demolition and closure during 2007. The report should be edited to reflect the demolition of the smelter and to document that this area is addressed under an operational discharge permit.

The six samples collected along the fence line were to be used as nature and extent for understanding source points for the Hurley IU, not as exposure point concentrations (EPCs) for the S/TSIU HHRA.

Response: NMED acknowledges that the Smelter area is part of an operational area. However, NMED has decided to keep the Smelter area in the HHRA, as the information may be used to guide future remedial decisions which may relate to abatement under the Discharge Permit.

3. Data Adequacy for Exposure Areas 1, 2 and 3

As discussed in Section 2.4.5, the available unsieved or <2,000 micron (μm) soil data for a number of the food consumption pathways are extremely limited. Given the paucity of data, use of sieved data should be considered with caveats. While the preferential use of the unsieved data is explained, the use of the sieved data would have resulted in greater certainty than the use of a single sample to estimate the EPC because the sieved data are more conservative (*i.e.*, higher concentration) and thus provide an upper-bound on the risk estimate. In 2005, Chino recommended that the sieved data be used to fill the data gap, and in reviewing the HHRA, there does not appear to be a significant concentration difference in the sieved versus unsieved for the exposure point concentrations (EPCs), especially compared to the uncertainty introduced with using the smaller data sets. Therefore, increasing the certainty of the data will not appreciably change the conclusions of the HHRA and Chino recommends using the sieved data to augment the dataset for the food consumption.

Response: Uncertainty is introduced in the risk estimates both by the use of inadequate data, and the use of non-representative data. Use of non-representative sieved data to augment the dataset for the food pathways will tend to overestimate EPCs and risk. However, the risk from the food pathways is already highly uncertain and likely an overestimate, due to a number of uncertainties in the inputs. Therefore, augmenting the dataset to refine the EPC (and increase the risk) is likely to be of limited benefit, particularly when the food pathway risks are already overestimated.

4. Identification of Chemicals of Potential Concern (COPCs)

Chino does not agree with the entire list of chemicals of potential concern (COPCs) identified by Gradient. Thallium and vanadium are clearly unrelated to site operations. Specifically, there is no decreasing concentration gradient for these constituents away from the Hurley operations area and concentrations of these constituents are higher in background than in the S/TSIU. It may simplify risk communication to eliminate these constituents up front.

Gradient did not eliminate constituents from the risk assessment based upon a comparison to background concentrations. As discussed in Chino's previous comment on risk communication, it is important that the

public understands all relevant factors behind the risk evaluation. Gradient does not clearly explain the importance of understanding how site concentrations relate to background until Section 5.3.1, 103 pages into the report.

The risk assessment indicates that the lower of either the US EPA Region 6 "RCRA Human Health Medium-Specific Screening Levels" (MSLs) for residential soil (US EPA Region 6, 2004), or the US EPA Region 9 Preliminary Remediation Goals (PRGs) for residential soil (US EPA Region 9, 2004) were used for risk-based screening criteria. In Tables 2-6 through 2-9, all screening levels except one are based on US EPA Region 9 standards. Since the Chino site is located within US EPA Region 6 and Region 6 has oversight of the AOC, Region 6 values should be used when US EPA Regions 6 and 9 have the exact same risk-based value for a COPC (both regions round their values to two significant digits and it is unclear why the values in Table 2-6 through 2-9 are summarized with greater than two significant digits).

US EPA Region 6 should be used for barium, iron and vanadium because updated toxicity criteria are pertinent to the correct evaluation of these metals. Chino agrees that the lower Region 9 values should be used for metals such as cadmium, manganese and thallium to be conservative.

Response: The general philosophy of both NMED and EPA Region 6 is that constituents are not eliminated "up front" in the risk assessment by a comparison to background. Constituents are retained as COCs in the HHRA if they exceed health based screening levels, so that a full picture of risk is obtained. This approach was described in the Work Plan dated July 2005.

The text will be edited to discuss background earlier in the document.

EPA Region 6 will be cited as the source of screening values in Tables 2-6 to 2-9 when Region 6 and Region 9 have the same screening value and screening values will be rounded to two significant digits.

The EPA Region 6 screening value will be used for barium, because it is based on an updated toxicity value that has documentation in EPA's IRIS database.

We will need to obtain documentation on the basis for the RfD values used by Region 6 for iron and vanadium, before using the Region 6 screening values based on these RfDs. The RfD for iron is a provisional value, and we will ask Region 6 to provide documentation of this value. Region 6 lists IRIS as the basis for the vanadium RfD of 5E-03; however, IRIS only lists a value for vanadium pentoxide, which is 9E-03. Upon receipt of the basis for the updated toxicity values, NMED will decide if the toxicity values and their associated screening values can be used.

5. Uptake Pathway Exposure Assumptions

Chino continues to have significant concerns about the inclusion of the ingestion of homegrown vegetables, locally-raised chickens and eggs, and beef as relevant exposure pathways for this IU. These exposure pathways are incomplete under current exposure conditions and it is highly unlikely that these exposure pathways would be complete any time in the foreseeable future. In the S/TSIU, there are currently no residents with gardens or poultry. In addition, the S/TSIU soils are too poor to harvest homegrown vegetables due to a lack of organic carbon and other nutrients. A productive garden in S/TSIU would need to be supplemented with peat or other carbon enriched soil sources on a regular basis to produce a viable and consistent source of vegetables.

The poorly defined and highly conservative assumptions used in the produce, poultry, and beef ingestion exposure pathways have been shown in the past to result in an overestimation of risk. In Hurley, NMED identified arsenic as a potential risk driver in produce in the Hurley Soils IU HHRA; however, when actual samples were collected from Hurley resident gardens along with produce samples from nearby markets, arsenic was much lower than the concentrations predicted by the model (Golder, 1998). Similarly, at Questa Mine near Taos, New Mexico, US EPA predicted higher metal concentrations in produce than was determined when

samples of homegrown produce were analyzed for metals (US EPA, 2005). Our specific comments on the exposure parameters and uptake factors are as follows:

- On page 58, the text says "these intake rates are for consumers of homegrown vegetables only. Many individuals may not eat any homegrown vegetables. Out of 552 residents in the town of Hurley (US Bureau of Census, 1991), only 30 active vegetable gardens were identified in the town of Hurley during the Phase I RI (Golder, 1998)." However, the number of vegetable gardens in Hurley has no bearing on the number of potential future gardens in the S/TSIU. Page 30 indicates that "we have no indication that current residents have vegetable gardens, future residents may grow their own vegetables." In addition, all gardens in Hurley were amended to improve the soil quality which was not conducive to harvesting vegetables. In the S/TSIU, the soil quality is similar to Hurley Soils IU and thus amendments would have to be applied to successfully harvest vegetables. Also, the types of vegetables that were found in Hurley were not subsistence type of produce. Chilies and tomatoes were identified in the majority of gardens; however, the exposure assumptions in the HHRA are reflective of nearly subsistence intake as detailed below.

- Ingestion rates for produce of 1.2 g/kg-d for vegetables translates into about 110 cups of vegetables for children and 440 cups of vegetables for adults annually. While these rates were modified to account for moisture content, the base rate is still indicative of large quantities of produce. Ingestion rates for poultry and eggs at 1.3 and 1.05 g/kg-day translates into about 74-4 ounce servings of meat and 120 eggs for children annually and 300-4 ounce portions of meat and 482 eggs for adults annually. These values are approaching subsistence intake and are not reflective of actual exposure in the IU because there are currently no gardens in the IU and, as the HHRA points out, there may never be any gardens in the future. Section 3.8 lacks a sub-section with technical detail on the ingestion rates for chicken meat, eggs, and beef.

- Exposure frequency of 350 days per year is used in the HHRA; however, 350 days is much too conservative for the ingestion of produce and poultry exposure pathways given the climate conditions, including precipitation and temperature fluctuations during the year that prohibit harvesting home-grown produce year-round. An exposure frequency of 90 to 120 days per year is more realistic given the type of gardening that is actually taking place in the IU.

- The HHRA cites to Neptune (2005) for the ingestion of homegrown vegetables; however, Neptune included parameters for the contaminated zone and root zone for plants. The contaminated root zone in S/TSIU is in the top inch to six inches while roots grow three feet deep in some cases and, therefore, modification of the intake to reflect a substantial portion of the roots occurring below the contaminated zone would be technically appropriate.

Response: NMED agrees that the risks from the food pathways are highly uncertain, and it is unlikely that a particular individual would have exposure to all four food pathways. However, the food pathways were included in the risk assessment as the result of a citizen request at a public meeting, and although they may not be complete pathways under current conditions, they can not be ruled out under future conditions. Thus the food pathways will be retained in the HHRA.

The food pathway ingestion rates are based on data presented in the EPA Exposure Factors Handbook (1997). These ingestion rates were used because they are the only published data available. The exposure frequency of 350 days/year is consistent with the fact that the data represent yearly average intakes, *i.e.*, seasonal intakes that were averaged over the whole year. It would not be correct to use yearly average intakes for only a portion of the year.

Vegetable roots are generally not deeper than one foot. The vegetable intake will not be modified to account for root depth. This uncertainty will be noted in the HHRA.

6. Toxicity Criteria

Similar to comments discussed in No. 4 regarding Identification of Chemicals of Concern, Section 4 and Table 4-1 discuss the use of U.S. EPA Regions 3 and 9 PRG tables as sources for toxicity information when Region 6 provides more updated toxicity information. Toxicity criteria from Region 6 should be used because it is the most recent criteria and Region 6 has oversight of the AOC.

Response: Updated toxicity criteria from Region 6 will be used where appropriate, provided NMED can obtain documentation of the basis for the updated values.

7. Calculation of Risk-Based Concentrations

It is unclear why risk-based concentrations (RBCs) are estimated for those constituents that are shown to be statistically less than background (*i.e.* iron, thallium, and vanadium). Chino recommends that these constituents be removed from Table 6-1. The background upper tolerance limit (UTL) for each constituent should be reported for comparison.

Response: RBCs for thallium and vanadium will be removed from Table 6-1. The RBC for iron will remain because the mean concentration for iron in EA3 is greater than that in the Reference area. The UTL for background will be added to Table 6-1 for comparison.

Detailed Technical Comments

Executive Summary

1. While the text indicates that we looked at current and future residents, the spreadsheets and summaries of results do not make this differentiation. It is recommended that the differentiation be made more apparent throughout and that it be discussed in more detail in the risk characterization and uncertainty sections. Emphasis should be on a future resident since there are currently no residents living in the IU.

   Response: NMED notes that EA1 has residents within the AOC boundary, near Bayard. Nevertheless, the text will be modified to emphasize future residents where appropriate.

2. Chino suggest that CTE risks also be presented in the summary table and discussed more specifically in the text.

   Response: The CTE risks will be added to the summary table and discussed in the text.

3. At the end of the first paragraph, change the sentence to read "Risk was evaluated in five exposure areas, the Smelter Area, and a Reference Area that is not impacted by the smelter or tailings pile."

   Response: The text will be modified.

4. 2nd paragraph: At the end, change "so as to overestimate risks" to "so as to ensure that risks were not underestimated."

   Response: The text will be modified.

5. 3rd paragraph, second sentence: Add "in all exposure areas" after the risk range.

   Response: The text will be modified.

6. p. ES-3, 1st paragraph, 1st sentence: change "indicated" to "indicates"

Response: The text will be modified.

7. p. ES-4, 3rd paragraph, 3rd sentence: Insert semicolon after "exposure factors"

Response: The text will be modified.

Section 2

8. It would be helpful to have a figure that shows the conceptual site model, including transport mechanisms, identified receptors in each area, and the exposure media and pathways.

Response: A CSM in the form of a flow chart will be added to section 2.4.3.

9. Make it clear at the beginning that the highest concentrations are in the topmost layers of soil so that this is an ultra-conservative approach given that exposures in many cases would include deeper, less contaminated soils.

Response: NMED disagrees with this statement; for most people who have casual contact with surface soil, the exposure will be to the top surface of the soil, and soil from the 0-1" interval is a reasonable approximation of the soil they might be exposed to. The text will not be modified.

10. Figure 1 shows shading in Exposure Area 1 and 4 that includes the Hurley Soils IU. This should be caveated or clarified so as not to confuse the reader that current residents in the Hurley Soils IU are also included in this IU because they are not.

Response: The text will be modified.

11. Figure 1 does not provide enough information to locate all of the features that are discussed in the text. Make sure that the discussed features are listed. It would also be helpful to insert Figure 2-1 from the Remedial Investigation, showing detail of the smelter area.

Response: The text will be modified.

12. Page 10, first full paragraph, the word "streams" should be edited to "ephemeral drainages" because the word "stream" suggests perennial flow.

Response: The text will be modified to read "ephemeral, intermittent and possibly perennial water courses".

13. Page 11, last paragraph, the dominant wind direction is east-southeast not west-northwest.

Response: The text will be modified.

14. In Table 2-2, some of the background ranges are provided as percentages rather than concentrations. This makes comparison difficult. It is recommended that all units be presented as concentrations with appropriate footnotes to indicate those values that have undergone conversion.
Response: The text will be modified.

15. Table 2-2 borders are inconsistent.

Response: The table will be modified.

16. Section 2.4.3: Add groundwater as a possible exposure route.

Response: The text will be added.

17. Table 2-3: It is unusual that the 0-6 inch data have been used for the inhalation pathways but that only the 0-1 inch data have been used for the direct contact pathways because one would expect that the entrained dust would only be from the very top-most layer of soil. Also, use of 0-1 inch data is very conservative, requiring discussion in this section of the HHRA. The uncertainty section of the HHRA should also discuss how conservative this assumption is and how it is likely to result in overestimated risks. For example, construction workers will probably be exposed to 0-6 feet (rather than 0-6 inches) and produce grown on soils will likely have roots deeper than just 6 inches.

Response: The area used for the air lead modeling was very large. The air modeler felt it was important to have soil data with as much aerial coverage as possible, therefore, all soil data with a top depth of zero inches were used as inputs for the air modeling.

NMED disagrees that use of 0-1" soil is ultra-conservative. Most people who have casual contact with surface soil (*i.e.*, all receptors except the construction worker), have exposure to the top surface of the soil, and soil from 0-1" is representative of their exposure. Text will be added regarding construction worker exposure and produce root depth.

18. Table 2-3: Similarly, it is possible that the HHRA may underestimate risks for vegetable consumption because of dust on harvested plants and any chemicals applied by a resident that are taken up through plant roots. This scenario assumes vegetables are not washed prior to consumption. Again, this needs to be explained more fully.

Response: Text will be added to indicate that this exposure scenario assumes that produce are washed before consumption in Table 2-4 as a footnote and Section 3.2.5. Text will not be added to discuss other chemicals that may be applied to plants, because this risk assessment concerns exposures to site related contaminants only. People are exposed to many chemicals in the course of their lives that are not site related; a discussion of these exposures is not germane to this assessment.

19. Table 2-3: There is no discussion of why deeper soils have not been evaluated. Chino assumes deeper soils were not evaluated because previous investigations have demonstrated that the surface soils have the highest concentrations. The text should clarify that the Phase I RI Report and the Ecological IU RI Report concluded that contamination is largely in surface soil.

Response: The text will note that contamination is largely in surface soil. However, deeper soils were not evaluated due to a lack of data. The soil depths to be evaluated were agreed upon with Chino at the HHRA scoping meetings, and were presented in the July 2005 Work Plan. Additional data needs were presented by Gradient in a Data Needs Memo (5/18/06), and discussed with Chino at a meeting March 19, 2006.

20. Table 2-4: Remove italics under sample depth column for Exposure Area 1. Also, remove the quotation mark from the same column for Exposure Area 3.

Response: The text will not be changed. The italics are needed because the vegetable pathway should use 0-6" soil, but we used 0-1" soil because that was all that was available.

21. Additionally, the screening levels summarized in Tables 2-6 through 2-9 are reported in numeric formats up to six significant digits when the US EPA MSL or PRG tables are reported in scientific notations with two significant digits.

Response: The text will be modified.

22. The citation for Region 6 is incorrect on page 24 (US EPA Region 6, 2004) since the MSL table on the US EPA Region 6 website is dated 2007 and has updated toxicity criteria for barium, iron, and vanadium.

Response: The text will be modified.

23. The HHRA says that groundwater has not been evaluated for EA 1 or 4 due to a lack of data. Please provide a stronger rationale by indicating that groundwater concentrations are expected to be lower or the same as areas than have been evaluated for other EAs. Specifically, EA 4 is addressed by an operational and closure discharge permits and there are groundwater reports available for EA 4. In addition, several reports including the S/TSIU RI Report (SRK, 2006) conclude that there is no impact from the surface to subsurface soil and thus groundwater in these areas would not be affected via leaching of surficial soil constituents to groundwater.

Response: The groundwater data used in the risk assessment were selected during discussions between NMED, Chino, and SRK. Chino specifically excluded wells that are being monitored under the operational and closure discharge permit. NMED will not include statements about likely groundwater concentrations without supporting data.

24. Table 2-10: The Maximum Contaminant Level (MCL) is listed in the table but is not discussed in the text. Also explain what MSLs are, either in the table or in the text.

Response: The text will be modified and MSLs will be explained in Section 2.5.2 and Tables 2-6 through 2-8.

Section 3

25. There is no Section 3.2 and thus the section needs to be renumbered.

Response: The text will be modified.

26. The Kuo et al. 1983 reference is not listed in the reference list. In addition, on page 28 in the first paragraph there is a reference to US EPA 1992b associated with mobility of metals. However, the 1992b guidance is the dermal guidance. This may be referenced incorrectly.

Response: The text will be modified.

27. Section 3.3.6: Delete "in chicken meat and eggs" from the first sentence.

Response: The text will be modified.

28. Table 3-3: A Construction Worker may apply to all EAs but definitely to EA 4 which is adjacent to Hurley Soils IU and the next area likely to undergo development. The EAs are not well defined in the text in terms of current versus future uses. It would also be helpful in the text or in footnotes to the table to explain the differences among Recreator 1, Recreator 2, Trespasser 1 and Trespasser 2 (based on current terminology – it appears the difference is media driven but if this is the case, they could be just as easily be one receptor with different exposure assumptions for the relevant media/pathway. Specifically, this is an issue with Trespasser 1 and 2 which have different exposure frequencies: 10 days for Trespasser 1 (soil exposure) versus 12 days for Trespasser 2 (surface water and sediment) and it is unclear why they are slightly different). In addition, some borders are missing from the table.

Response: The report makes a distinction between recreators and trespassers, because NMED feels that some of the exposure areas are less accessible than others, due to the presence of fences and private property. As noted in the Work Plan (p.15), the hiking and swimming scenarios were evaluated for different receptors, so that risks, and the need for any remediation, could be identified separately for the stock ponds *vs.* soil. Since these receptors are considered different people, they have different exposure frequencies. It is assumed that hiking occurs more often than swimming. The risks for the hiker and swimmer are not added. To help clarify these receptors, Recreator 1 will be changed to Recreator-Hiker, and Recreator 2 will be changed to Recreator-

Swimmer. Similarly, Trespasser 1 will be changed to Trespasser-Hiker, and Trespasser 2 will be changed to Trespasser-Swimmer.

29. Section 3.6.1: The references to 1992b should be 1992c, based on the reference list. In addition, the text references US EPA 2002a but the "a" should be deleted as there is only one 2002 reference in the reference list.

Response: The text will be modified.

30. Section 3.6.3: If no analytes exceed screening criteria in surface water, why was that medium evaluated?

Response: It is true that no analytes exceed screening criteria in surface water. However, surface water was kept in the risk assessment in order to evaluate all exposure pathways for an adolescent who is exposed to both surface water and sediment while swimming in the stock ponds.

31. Section 3.6.4: Insert "arithmetic" before "average" to make it clear that these are not UCLs. Also, is there any information about the direction of migration of groundwater that would help show that other areas would have lower risk?

Response: The text will be modified to include the arithmetic mean. NMED will not include statements about likely groundwater concentrations without supporting data.

32. Section 3.6.6 and 3.6.7: Put the values for the feed ingestion rates and the fraction of soil in feed in the text.

Response: The text will be modified.

33. EPC tables: Chino recommends that EPCs be presented in general number format rather than scientific notation.

Response: Tables 3-13, 3-14, 3-15, and 3-16 will be modified accordingly.

34. Section 3.6.8: For clarity, it would be helpful to reference a table that outlines all of the parameters used in calculating uptake, rather than just having them in the text. In the last paragraph, the reference to US EPA 1995 should be 1995a and the reference to US EPA 1999 should be 1999a.

Response: Text will be added to state that all parameters used in calculating uptake are presented in the tables in Appendix C and the EPA references will be changed.

35. Section 3.7.3. The effective concentration in air is calculated based on 24 hours of exposure despite the fact that many scenarios would not have 24 hours of exposure. The approach is conservative and should be explained.
Response: The text will be modified.

36. Section 3.8. The next to last sentence is contradictory because it says, "a combination of RME and CTE exposure parameters were used to estimate exposures for the RME scenarios" when the prior sentence says, "RME values are generally 90th or 95th percentile values". Please clarify.

Response: The text will be modified.

37. Section 3.8. References to US EPA 1991 should be 1991a.

Response: The text will be modified.

38. Section 3.8.1, 1st par. Text concerning soil ingestion is contradictory with later text on page 62 which says that the 95th percentile reported by Stanek and Calabrese is lower than the 200 mg/day presented here.

Response: The text will be modified.

39. Section 3.8.1. The assumption of 100 percent bioavailability for all metals except arsenic is extremely conservative and even 50% for arsenic is very high. More appropriate values should be incorporated.

Response: The text states that the use of 100% bioavailability is a conservative assumption (p. 55). The bioavailability values will not be changed, due to a lack of published alternative values.

40. Page 56. It is not clear why the sources of adherence factors are inconsistent. Is there a reason to preferentially use the EPA Region 6 values for certain scenarios and the EPA Dermal Guidance for others?

Response: The EPA Dermal Guidance was used as the default for the child and adult resident. EPA Region 6 was used for other receptors.

41. Page 56. If only adolescents are retained as recreators, please specify the age group being evaluated.

Response: The text will be modified.

42. Page 59, 1st par. The exposure frequency for the recreator and the trespasser apply to all pathways, not just ingestion of soil. The same issue is true related to the sediment contact pathways. Please clarify.

Response: The exposure frequency for the hiker is different from that of the swimmer, because these receptors are considered to be different individuals, and their risks are not added together.

43. Section 3.8.2. Distribution inputs were incorporated for only four parameters? There are other parameters, such as dermal area, adherence factor, and bioavailability that can be incorporated. Also the reference to US EPA 2001 should be 2001a.

Response: The probabilistic uncertainty analysis was done only for soil ingestion, because this pathway has a greater contribution to risk than dermal contact. The reference will be changed.

44. Table 3-19. Insert "Future Residential" in the title. Provide specific references used to derive distributions and place units in the description of parameters. Also, explain why an upper bound adult ingestion rate of 200 mg/day is used when ½ child rate would be 100 mg/day?

Response: The maximum adult soil ingestion rate of 200 mg/day is based on professional judgment. There is only a 5% probability that a random pick from the distribution will select a value between the 95th percentile of 100 mg/day and the maximum of 200 mg/day.

45. Page 62, Exposure Frequency: Explain why people will have less contact with soil during the winter months.

Response: The text will be modified to note that people are assumed to have less contact with soil during the winter months because they spend less time outside due to cold weather and precipitation.

Section 4

46. It was not clear from reading the HHRA that risks associated with the reference concentrations would be evaluated, resulting in unexpected risk estimates appearing in the Risk Characterization section. It would be helpful to include information about reference EPCs, scenarios, etc. earlier in the document.

Response: The text will be modified to include this information earlier in the document.

47. Section 4.1, 2nd par, 3rd sentence. It is unclear why there is any need to used US EPA Region 3 or 9 when US EPA Region 6 is a valid database and US EPA Region 6 has oversight of the AOC.

Response: The text will be modified to cite USEPA Region 6 where possible.

48. Section 4.1.1. Recommend that you rewrite the first sentence to say "...that a sensitive population can experience without an appreciable risk of deleterious effects during a lifetime."

Response: The text will be modified.

49. Section 4.1.2. Clarify that arsenic is the only COC that is considered carcinogenic and is the only COC evaluated for carcinogenicity.

Response: The text will be modified.

50. Section 4.1.3. Explain how the AEL was derived for iron. On page 64, the text indicates that an AEL for inhalation was derived for iron, but on page 77, the text indicates that "there are no toxicity criteria (*e.g.*, an RfC) available for evaluating inhalation exposures to iron; therefore, inhalation of iron is not evaluated in the risk assessment.

Response: The text will be reviewed and modified.

51. Section 4.1.5, 2nd par, line 5. Change "that" to "than" and change "criteria" to "criterion"

Response: The text will be modified.

52. Page 68, end of first paragraph. Recommend that NMED report the oral RfD in units of mg/kg-day instead of µg/kg-day to avoid confusion.

Response: The text will be modified.

53. Section 4.2.1.3 and other places. The reference to US EPA 2004c may be incorrect. Check all references for 2004 US EPA documents to make sure the a's, b's, c's are correct.

Response: The references will be checked.

54. Section 4.2.4. Review the Superfund Provisional Peer Reviewed Toxicity Table for iron and contact the Superfund Technical Support Center at (513) 569 – 7300 to obtain the iron manuscript. Section 4.2.4.1 should be updated to reflect current scientific consensus regarding iron toxicity.

Response: NMED will request the documentation from Region 6 for the updated iron RfD provisional value. The risk calculations will then be revised to use the EPA Region 6 oral RfD for iron.

55. Section 4.2.4.1. It appears that the US EPA 1999b reference should be 1999c.

Response: The references will be checked.

56. Section 4.2.4.2. 1st line. In first sentence, remove capital from "Iron" and change reference to read (US EPA 1984).

Response: The text will be modified.

57. Section 4.2.6.1, 2nd par, last line. Change US EPA (1987b) to US EPA (1987).

Response: The references will be checked.

58. Section 4.2.6.1 3rd paragraph, first line. Change reference to ATSDR (1992b).

Response: The references will be checked.

59. US EPA Region 6 uses an oral reference dose (RfD) of $7x10^{-1}$ mg/kg-day for iron instead of $3x10^{-1}$ mg/kg-day cited in Table 4-1 based on the Provisional Peer Review Toxicity Value (PPRTV) Tables issued by US EPA's National Center for Environmental Assessment (NCEA).

Response: NMED will request the documentation from Region 6 for the updated iron RfD provisional value. Assuming documentation is available the risk calculations will be revised to use the EPA Region 6 oral RfD for iron.

60. Table 4-1 cites to US EPA (1987) "Health Effects Assessment for Vanadium and Compounds" for the vanadium oral RfD of $1x10^{-3}$ mg/kg-day; however, the Health Effects Assessment Summary Tables (HEAST) (1997) cite to the same document and report a value of $7x10^{-3}$. It is unclear why US EPA Regions 3 and 9 cite to an Environmental Criteria and Assessment Office (ECAO) value, HEAST reports a value from the same reference, and US EPA Region 6 reports $5x10^{-3}$ mg/kg-day. These issues should be further researched and clarified in the HHRA. If the oral RfD is either $5x10^{-3}$ or $7x10^{-3}$ mg/kg-day, then the vanadium screening level would not exceed the maximum detected concentration and vanadium would not qualify as a chemical of potential concern.

Response: The vanadium toxicity values will be checked and revised if appropriate.

Section 5

61. Page 94, 1st par. As well as later sections. Clarify that the vast majority of risk for the food ingestion pathways is due to vegetables rather than other food products.

Response: The text will be modified.

62. Page 93, 2nd par. Indicate that cancer risks are reported in Tables 5-1a through 5-1c for the RME and 5-2a through 5-2c for the CTE scenario.

Response: The text will be modified.

63. Page 109, last line. Capitalize (b)

Response: The text will be modified.

64. Table 5-10. This table is hard to read because of the way it is aligned. It is recommended that all cells be aligned at the top rather than the center for clarity.

Response: The text will be modified.

65. Page 116, 1st full par., 3rd line. Change "concentration" to "concentrations."

Response: The text will be modified.

66. Page 118, last par. States that the use of half the detection limit for non-detects is highly conservative because concentrations may be significantly lower. However, it is also important to note the concentrations could be higher than ½ the DL.

Response: The text will be modified.

67. Page 121. If the decision is made not to use reduced oral bioavailability factors for these metals, then a statement that this is extremely conservative and provide quantitative estimates of how much risk would be decreased if lower values are used.

Response: The text will be modified.

68. Page 125, last par. Explain that it is very conservative to use the short-term dietary data for any type of consumption, particularly the 75th percentile and when based on "consumers" only.

Response: The text will be modified.

69. Section 5.5.4, 2nd line. Insert "combined" before "uncertainty factors"

Response: The text will be modified.

70. Page 126, 2nd par, last line. Remove all commas except the first.

Response: The text will be modified.

71. Page 128, 2nd par. Insert "(or 0.003 mg/day)" after 3 µg/day

Response: The text will be modified.

72. Section 5.5.5. Provide target organs associated with the RfDs for each COC and differentiate between total risks estimated here and organ-specific risks to show whether any of the target organ-specific risks exceed benchmarks.

Response: The text will be modified.

Section 6

73. Table 6-1. We proposed that NMED show risks associated with reference concentrations in this table.

Response: Table 6-1 shows RBCs for soil, it does not show risk. The risks from the reference area will not be added to this table.

74. On page 137, the following paragraph should be revised: "*For copper, we used an RfD of 0.04 mg/kg-day, the value used by US EPA Region 9 in deriving its PRG for copper. It is interesting to note that the resulting copper RBC is 3,129 mg/kg, which is quite similar to both the health-based value of 3,100 mg/kg that we developed for the Hurley Soils IU based on our probabilistic model of copper concentration in the stomach.*" The RfD should be based on the Region 6 PRG for copper, not Region 9. Additionally, it should be noted that this RfD is based on water quality criteria and that an RfD is not reported on EPA's Integrated Risk Information System (IRIS). The statement incorrectly cites to a health-based value of 3,100 mg/kg when this is a value that pre-dated the release of an addendum to the Hurley Soil IU HHRA summarizing a range of pre-Feasibility Study (FS) values. The statement should acknowledge that the copper RBC was determined by a dispute resolution process where a final Pre-FS remedial action criteria (RAC) standard was established at 5,000 mg/kg.

Chino proposes 5,000 mg/kg be referenced as an RBC since the exposure assumptions for S/TSIU are essentially the same as Hurley Soils IU and residents are not currently living in the IU.

Response: The paragraph about copper cited here will be deleted. The copper RBC in Table 6-1 will be changed to 5,000 mg/kg, and the table will be footnoted to state that this value comes from the Amendment to the Administrative Order on Consent that established the RAC for copper in the Hurley Soils IU.

Section 7

75. Risk-based concentrations for iron, thallium and vanadium should be inserted with a discussion that they are below background levels. As discussed in more detail under General Comments, Chino recommends that these constituents be added and compared with background or excluded from the summary of risk-based concentrations.

Response: NMED will consider whether to remove RBCs that are below background levels from Table 6-1. If they are removed, then they will not be discussed in Section 7. If they are not removed, the RBCs will be added to Section 7 with a discussion that they are below background levels.

76. Page 137, 1st par., last line. Insert "rather than underestimate" after "overestimate"

Response: The text will be modified.

77. Page 138, 3rd par. Consider reporting risks associated with residential pathways if NMED subtracts background risks.
Response: NMED has compared the S/TSIU risks to those in the reference area. However, NMED will not subtract the reference area risks from the S/TSIU risks, as this is not accepted practice in EPA Region 6.

78. Page 140, last par, 2nd line. After exposure pathways, replace current text with "for which exposure and risk estimates are highly uncertain."

Response: The text will be modified.

References

79. Kuo et al, 1983 needs to be added to the reference list

Response: The reference will be added.

80. Remove "Region 3" from the US EPA Region 3 2007 reference on the list and replace the current US EPA 2007 reference with the same citation.

Response: The reference will be changed to US EPA Region 3 April 2007 Risk-based concentration table (April 2007 update).

81. US EPA 1992a, 1992b, and 1992c appear to be incorrectly used throughout the text and should be corrected where appropriate.

Response: The references will be checked.

82. US EPA 2002 should be 2002a

Response: The references will be checked.

83. There is no reference for the US Bureau of Census (1991) in the reference list

Response: The reference will be added.

84. There are many references in the text to US EPA 2004c that should be reviewed to potentially be cited as 2004a.

Response: The references will be checked.

Tables

85. Table 2-6. The table should show both screening values used.

Response: Both screening values will not be shown because the report states that the lower of the two screening values (Region 6 MSLs and Region 9 PRGs) was used.

86. Table 2-7. Values for iron should be high-lighted. Also, for silver and other relevant compounds, replace 0.0 with ND.

Response: Values of 0.0 are not ND, they will be expanded to two significant digits.

87. Table 2-10. Footnote the references for PRG, MSL and MCL. Also, remove "No" everywhere that it follows "NA."

Response: The table will be revised.

88. Tables 3-10, 3-12, 3-13, 3-14, 3-15 and 3-16. The EA 1 column should be bold since EA 1 had one sample, and thus the EPC should be based on the maximum. Since EA 2 had 10 samples and a 95UCL could be calculated, it is unclear why the EA 2 column is bold in these tables.

Response: The EA 2 values will be checked and revised as needed.

89. Tables 3-17a and 3-18a. Change all US EPA, 1991 references to 1991a. Also, the exposure frequency for the ingestion of vegetables, beef, chickens, eggs, etc. should be 365 days/year as those ingestion rates are based on average, annualized averages.

Response: References will be revised. [This comment is not consistent with Comment 5, 3rd bullet.] NMED agrees that the ingestion rates are based on annualized averages, *i.e.*, seasonal intakes that were averaged over the whole year. An exposure frequency of 350 days/year was used to be consistent with the soil exposure frequency for the resident.

90. Table 3-17c. The current Construction scenario is inaccurate. In addition to the ingestion rate that can be questioned, a construction exposure frequency of 225 days is excessive. Typically, construction is conducted for six months (130 days) or one year and, for the noncancer endpoint, an averaging time of 130 days. Finally, change US EPA 1991 reference to 1991a.

Response: Construction of new homes could last approximately 6 months to one year. We will consider changing the exposure frequency to 225 days/year for RME and 130 days/year for CTE. In addition, we will consider changing the exposure duration from 25 years to 1 year and 0.5 year for RME and CTE, respectively. However, it should be noted that even using the overly conservative assumptions of 225 days/year for 25 years, the risks to this receptor were below the target risk levels. Reducing the exposure frequency and duration will lower the total cancer and non-cancer risks, but will not change the conclusions for this receptor.

91. Table 3-17d, 3-18b, 3-18d, 3-18e. Change US EPA 1991 to 1991a

Response: The table will be revised.

92. Table 3-17c. Change US EPA 1991 to 1991a.

Response: The table will be revised.

93. Tables 3-17g, 3-17h, and 3-17i. Remove italicized note at bottom

Response: The table will be revised.

94. Tables 3-18f and 3-18g. Why do the RME and CTE scenarios have the same exposure frequencies as the RME scenarios?

Response: This exposure frequency was decided at the time the Work Plan was prepared. However, the exposure frequency for the CTE scenario could be reduced.

95. Table 3-18a. Change US EPA 1991 to 1991a. Also, reference to US EPA 2002b is not in the reference list. Check all tables for references to 2004 a, b and c for correction.

Response: The table will be revised and references will be checked.

96. Table 4-1. Add "c" to the US EPA-NCEA (1999) reference. In last footnote, add "b" after 1986. Also, the reference list is not complete in that it does not provide references for all information provided in the table.

Response: The table will be revised and references will be added.

97. Table 4-2. Add "b" to the US EPA 1999 reference in the footnote. Also, the Unit Risks are mentioned in the text but not listed in the table and should be consistent.

Response: The reference in the table will be revised. The unit risks in the text and table are consistent, therefore text will not be changed.

98. Table 4-3 and 4-4. The IRIS reference at the bottom does not conform with the reference in the W-O-E column. Change one or the other for consistency.

Response: The reference will be checked.

99. Table 4-5. In footnote [b], the year of the guidance should be provided. In addition, none of the inhalation toxicity benchmarks are provided and should be added.

Response: The year will be added. The inhalation toxicity benchmarks are provided in Tables 4-2 and 4-4. They are not reported in Table 4-5 because this table only provides dermal toxicity values.

100. Table 4-6. This table is more appropriately placed in the uncertainty analysis.

Response: The table will stay in Section 4.

Appendix F

101. Page F-3. It is not clear how to justify the conversion factor that is used in Equations 1 and 3. The AEC and $C_{stomach}$ units cancel, and so it appears that the mg/kg conversion factor has arbitrarily been added to the equation

to justify the units for the $HourlyC_{soil}$. Clarify and provide a justification as to why this conversion is appropriate, if it is correct.

Response: The conversion factor is appropriate, and is analogous to the conversion factor used in the soil ingestion exposure equation, where we have a soil concentration in mg/kg, and a soil ingestion rate in mg/day. An explanation for the conversion factor is provided below.

At the $HourlyC_{soil}$, the AEC for copper should equal the concentration of copper in the stomach:

$$\frac{AEC(mg/L)}{C_{Cu,stomach}(mg/L)} = 1 \qquad \text{(a)}$$

$C_{Cu,\ stomach\ (mg/L)}$ after an hour of soil ingestion can be written as follows:

$$C_{Cu,stomach}(mg/L) = \frac{Soil_{ing}(mg) \times C_{Cu,Soil}(mg/kg) \times F_{hour} \times B \times \frac{kg}{10^6 mg}}{V_{stomach}} \qquad \text{(b)}$$

where $Soil_{ing}$ is the amount of soil ingested in one day, $C_{Cu,soil}$ is the concentration of copper in soil, F_{hour} is the fraction of daily soil mass ingested in one hour, B is bioaccessibility, the conversion factor is needed to put the soil copper concentration in mg/mg, and $V_{stomach}$ is the volume of fluid in the stomach, given as a total here for simplicity.

If we substitute equation (b) into (a), and solve for $C_{Cu,soil}$ we get equation (c).

$$C_{Cu,soil}(mg/kg) = \frac{AEC(mg/L)}{\frac{Soil_{ing}(mg) \times F_{hour} \times B \times \frac{kg}{10^6 mg}}{V_{stomach}}} \qquad \text{(c)}$$

Noting that the concentration of soil in the stomach, $C_{soil,stomach}$(mg/L) is equal to:

$$\frac{Soil_{ing}(mg) \times F_{hour} \times B}{V_{stomach}}$$

And that for the case where equation (a) is true, $C_{Cu,soil} = HourlyC_{soil}$, Equation (c) becomes:

$$HourlyC_{soil}(mg/kg) = \frac{AEC(mg/L)}{C_{soil,stomach}(mg/L) \times \frac{kg}{10^6 mg}}$$

or:

$$HourlyC_{soil}(mg/kg) = \frac{AEC(mg/L)}{C_{soil,stomach}(mg/L)} \times \frac{10^6 mg}{kg}$$

102. Section F.4.2.1. The soil ingestion rate should be reported to be a truncated lognormal distribution

Response: The text will be modified.

103. Section F.4.2.2. Clarify the assumption that 100% of ingestion can be received as a bolus dose. This is extremely conservative. It appears, based on the data, that the probability distribution for this factor should instead range from 0 to 0.44.

Response: The probability distribution from Zartarian et al. (1998) was based on only four children. Also, based on the shape of the hourly soil distribution, selection of 100% as the fraction of daily soil ingested in an hour will be very infrequent, and in fact, can only occur if 100% is selected for the first hour of the day.

104. Page F-11. 2nd line. The word "distribution" is misspelled. Also in the first line, the word stomach is misspelled. In the third line of Section F.4.4.1, the mean gastric fluid volume is reported to be 0.4 + 0.45 mL/kg. Is this supposed to be ± rather than +?

Response: The text will be modified. The symbol in F.4.4.1 should be ±.

105. Section F.4.4.2, 3rd line. The word "and" is misspelled

Response: The text will be modified.

106. Page F-13, 3rd par and Page F-19, 1st line. Please clarify whether the 1268 g/day intake rate is based on consumers only or per capita.

Response: Data are presented as "mean quantities consumed per individual", based on data collected in the survey.

107. Table 1. Indicate that the daily soil ingestion rate distribution is truncated.

Response: The text will be modified.

108. Page F-18. There is no reference for NLM 2001. Should this be NLM 2003 or NAS 2001? Also, the assumption of a 3 hour stomach emptying period may be conservative? Cu uptake is likely to be greater when the stomach is empty. If so, it seems that NMED should use a longer stomach emptying time to be conservative.

Response: The reference should be NLM 2003, the text will be changed.

Re: stomach emptying time: This comment was addressed in a Gradient memo dated March 17, 2005. (First response under Comments from Linea). The March 2005 response is attached to this memo.

Reference: Gradient Corporation. 2005. Memorandum to Chris Eustice and Phil Harrigan (NMED), from Barbara Beck, Shijin Ren, and Mara Seeley (Gradient). Response to Comments from Chino Mines Corporation re: the New Mexico Environment Department's Proposed Remedial Action Criterion. March 17.

109. Figure 8 and associated text on Page F-26. Clarify how a probability is determined from the figure provided.

Response: The probability is not determined from the figure, it is determined from the distribution which is represented by the figure. Percentiles of this distribution correspond to daily probabilities, so for a given C_{soil}, we calculate which percentile of the min RAC distribution it corresponds to (this is the distribution shown in Figure 8). This percentile is the same as the probability that the given C_{soil} value will result in a nausea event on a given day.

110. References. The references for USDA (1998) and Gradient Corporation (2004) cited in the text are not listed in the reference list. In addition, why is the 2001 draft dermal guidance referenced rather than the final guidance? There are also a number of references listed that do not appear in the text of Appendix F. These include

ATSDR, 2002; Bhandari and Andrews, 1991; Chuttani et al, 1965; Fukui et al., 1994; Mackay and Andres, 1983; Makale and King, 1992; NRC, 2000; Pratt et al., 1985; Spitalney et al., 1984; US EPA, 1997; and Wang and Borison, 1951. These should be deleted.

Response: References for USDA and Gradient will be added. The citation for the dermal guidance will be changed to 2004. References not used in the report will be removed from the reference list.

USDA (1998) refers to:
U.S. Department of Agriculture, Agricultural Research Service. December 1998. Data Tables: Food and Nutrient Intakes by Region, 1994-96. ARS Food Surveys Research Group.
http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/Region.PDF

Gradient Corporation (2004) refers to the Addendum for the Hurley Soils IU HHRA.

111. Several of the figures have no scale on the "y" axis.

Response: The figures come directly from Crystal Ball, and we do not have a way to add the scale to the y-axis. However, the information provided is sufficient to define the distributions in Crystal Ball.

Appendix G

112. Appendix G requires more information to be understandable. A text summary would be very helpful. In addition, the table for EA 3 Resident is confusing. It appears that the shaded areas are the factors for which distributions were used and that this figure is just one iteration of the model that coincidentally has selected the default RME exposure frequency, duration, and body weight, but then has a different soil ingestion rate. More discussion is required for clarity.

Response: A brief text summary will be added. The EA 3 table will be modified.

Attachment for Comment 108: Response to Comments from LINEA (March 17, 2005)

1) LINEA suggests that the gastric emptying rate used in Gradient's RAC analysis (as reflected by a coefficient for gastric emptying of 1.2/hr, equivalent to a half-life for gastric emptying of 22 minutes), is not warranted, based on data from several other studies which report gastric emptying half-lives for solids ranging from 60 to 120 minutes.

Gradient has reviewed several of the studies cited by LINEA and the data presented in these studies support Gradient's selection of three hours as the time required for the stomach to empty after a meal (which is based on Maltby, 2000, who reported a range of 3-5 hours as the time required for the stomach to empty after a meal). The figures below (Figures 5 and 6) are from the study by Moore *et al.* (1981) that was cited by LINEA. These figures show gastric emptying for solids (Figure 5) and liquids (Figure 6) following ingestion of meal sizes of 300, 900 and 1,692 grams. These graphs indicate that gastric emptying is a function of meal size, with faster emptying rates for smaller meals; and that gastric emptying differs for solids *vs.* liquids, with liquids emptying at a faster rate, in an exponential manner, and solids emptying at a slower rate in a linear manner. Because Gradient assumed a meal size of 317 grams, it is most appropriate to consider gastric emptying rates for the 300-gram meal. If the line in Figure 5 for the 300-gram meal were extended, it would cross the x-axis (at which point the stomach would be empty) at approximately 2.5 hours. Figure 6 indicates that approximately 100% of liquids would be emptied from the stomach within two hours. Hence, the data from the study by Moore *et al.* suggests that if anything, the RAC analysis should have been based on an emptying time of less than three hours.

Another study cited by LINEA, by Montgomery *et al.* (1998), reported an average half-time for gastric emptying for solids of 78 minutes, in 11 children ages 5 – 11 years old. Because this half time is for a function

which is approximately linear, the time required for the stomach to completely empty would be approximately 156 minutes, or 2.6 hours (which agrees with emptying time for the 300 gram meal from the study by Moore *et al.*, 1981, discussed above). Similarly, the half-times for solids reported by Van Den Driessche *et al.* (2000) of 60-81 minutes for boys, and 66-88 minutes for girls, would correspond with emptying times of 2 – 2.7 hours for boys, and 2.2 – 2.9 hours for girls.

Note that it is not appropriate to compare the half-life for Gradient's analysis, in which the process of gastric emptying was assumed to follow an exponential decay function, with half-lives for solids from the studies discussed above, for which gastric emptying was observed to be linear. An exponential decay function will have a shorter half-life than a linear decay function, even if the total time for the stomach to empty is the same.

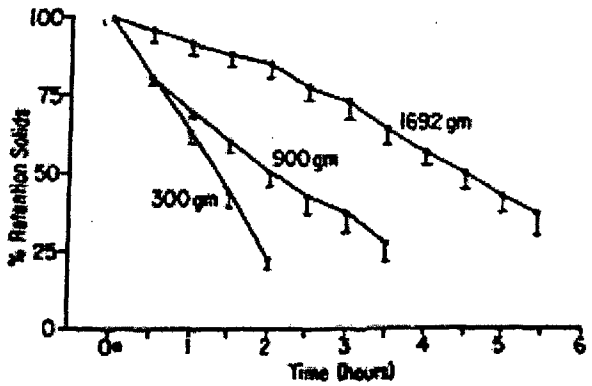

Fig 5. Solid-phase emptying patterns for filling meal (mean weight ingested = 1692 g), 900-g, and 300-g meals. *N* = 10 for filling meals. *N* = for 900- and 300-g meals. *Represents mid-meal time.

Source: Moore *et al.* (1981)

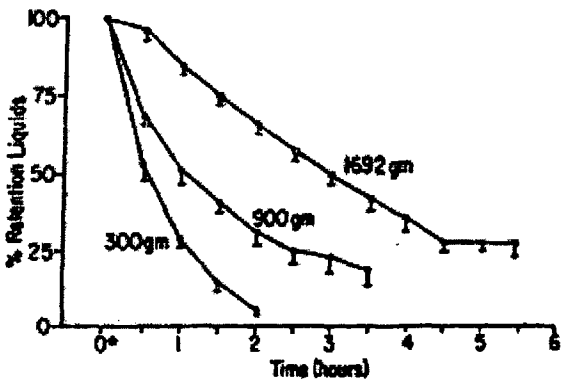

Fig 6. Liquid-phase emptying patterns for filling, 900-g, and 300-g meals. *N* = 10 for filling meals. *N* = 8 for 900- and 300-g meals. *Represents mid-meal time.

Source: Moore *et al.* (1981)

If you have any questions, please contact me at 388-1934.

Sincerely,

Phil Harrigan, Chino AOC Project Manager
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
Silver City Field Office

cc: Mary Ann Menetrey, NMED
Jerry Schoeppner, NMED
Mark Purcell, USEPA
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